

CLAIMS

1. A method for transferring information across a locked switch connection, the method comprising:
 - accepting information packets having a variable number of 5 cells, at a plurality of switch inputs, addressed to a plurality of switch outputs;
 - linking switch inputs to switch outputs; and,
 - locking the links to transfer the information packets.
- 10 2. The method of claim 1 further comprising:
 - parsing the information packets into lengths of a cell; and,
 - wherein locking the links to transfer the information packets includes transferring the information packet contents in units of a cell per decision cycle.
- 15 3. The method of claim 2 wherein accepting information packets having a variable number of cells, at a plurality of inputs includes accepting a first information packet at a first input, with a first plurality of cells, addressed to a first output;
 - wherein linking switch inputs to switch outputs includes linking the first switch input to the first switch output; and,
 - wherein locking the links to transfer the information packets includes transferring the contents of the first information packet, from the first input to the first output, one cell at a time, until the transfer is 20 complete.

4. The method of claim 3 wherein accepting information packets having a variable number of cells, at a plurality of switch inputs, includes a plurality of available switch inputs accepting information packets addressed to a common switch output;

5 the method further comprising:

arbitrating between the available switch inputs for the switch output; and,

wherein linking switch inputs to switch outputs includes linking the switch input to the switch output in response to arbitration.

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5. A method for transferring information across a locked switch connection, the method comprising:

accepting information packets having a variable number of cells, at a plurality of switch inputs, addressed to a plurality of switch outputs, where a plurality of available switch inputs accept information packets addressed to a common switch output

parsing the information packets into lengths of a cell;

arbitrating between the available switch inputs for the switch output;

20 selecting the least recently used available switch input;

linking the switch input to the switch output; and,

in response to arbitration, locking the link to transfer information packets in units of a cell per decision cycle, until the transfer is complete.

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6. The method of claim 5 in which a first plurality of switch outputs are included; and

the method further comprising:

following the accepting of the information packets at switch

5 input, queuing the information packets into a first plurality of virtual output queues, differentiated by the switch outputs to which the information packets are addressed; and,

wherein arbitrating between the plurality of available switch inputs includes arbitrating between a plurality of available switch inputs,

10 each available switch input having a virtual output queue with an information packet addressing a common switch output.

7. The method of claim 6 wherein arbitrating between the plurality of available switch inputs includes establishing an available switch input priority list for each switch output; and,

wherein selecting the least recently used switch input includes selecting switch inputs in response to the available switch input priority list.

20 8. The method of claim 7 wherein arbitrating between the plurality of available switch inputs includes arbitrating in a plurality of arbitration cycles.

9. The method of claim 8 wherein arbitrating in a

25 plurality of arbitration cycles includes each arbitrating switch output simultaneously nominating a switch input.

10. A method for transferring information across a locked switch connection with a first plurality of switch outputs, the method comprising:

5 accepting information packets having a variable number of cells, at a plurality of switch inputs, addressed to a plurality of switch outputs, where a plurality of available switch inputs accept information packets addressed to a common switch output;

10 queuing the information packets into a first plurality of virtual output queues, differentiated by the switch outputs to which the information packets are addressed;

15 parsing the information packets into lengths of a cell; simultaneously nominating switch inputs and arbitrating between a plurality of available switch inputs, each available switch input having a virtual output queue with an information packet addressing a common switch output, in a plurality of arbitration cycles as follows:

for each switch output, nominating the highest priority available switch input from an available input priority list in a first arbitration cycle; and,

20 if the nominated switch input is not selected, nominating successively lower priority available switch inputs in subsequent arbitration cycles;

selecting the least recently used switch input in response to the available input priority list;

25 linking switch inputs to switch outputs; and,

locking the links to transfer information packets in units of a cell per decision cycle, until the transfer is complete.

11. The method of claim 10 further comprising:
5 for each switch input receiving multiple nominations,
arbitrating between the nominating switch outputs.

12. The method of claim 11 wherein arbitrating between
the nominating switch outputs includes accepting the least recently used
10 nominating switch outputs.

13. The method of claim 12 wherein accepting the least
recently used nominating switch outputs includes:

15 for each switch input, establishing a nominating output
priority list; and,
accepting nominating switch outputs in response to the
nominating output priority list.

14. The method of claim 13 wherein arbitrating between
20 the nominating switch outputs includes each arbitrating switch input
simultaneously accepting a nominating switch output.

15. The method of claim 14 wherein arbitrating between
the nominating switch outputs includes accepting the highest priority
25 nominating switch output every decision cycle.

16. A method for transferring information across a locked switch connection with a first plurality of switch outputs, the method comprising:

accepting information packets having a variable number of
5 cells, at a plurality of switch inputs, addressed to a plurality of switch outputs, where a plurality of available switch inputs accept information packets addressed to a common switch output;

queuing the information packets into a first plurality of virtual output queues, differentiated by the switch outputs to which the
10 information packets are addressed;

parsing the information packets into lengths of a cell;
simultaneously nominating switch inputs and arbitrating
between a plurality of available switch inputs, each available switch input having a virtual output queue with an information packet addressing a
15 common switch output, in a plurality of arbitration cycles as follows:

creating a sequential input pointer for each
available input priority list;
for each switch output, nominating the highest
priority available switch input from the available input priority list
20 in a first arbitration cycle;

for each switch input receiving multiple
nominations, arbitrating between the nominating switch outputs by
accepting the least recently used nominating switch output as
follows:

25 for each switch input, establishing
a nominating output priority list; and,

simultaneously accepting
nominating switch outputs in response to the nominating
output priority list;

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following the acceptance of a
nominating output by a first switch input, setting the input
pointer to a second switch input, next in sequence to the first
switch input;

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if the nominated switch input is not selected,
nominating successively lower priority available switch inputs in
subsequent arbitration cycles;

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selecting the switch input;
linking switch inputs to switch outputs;
locking the links to transfer the information packets in units
of a cell, until the transfer is complete; and,
nominating the available switch input closest in succession
to the second switch input in a subsequent decision cycle.

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17. The method of claim 16 further comprising:
establishing a plurality of arbitration cycles in each decision
cycle; and,

wherein locking the links to transfer the information packets
includes transferring one cell per link, every decision cycle.

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18. The method of claim 17 further comprising:
creating a sequential output pointer for each nominating
output priority list;

following the acceptance of a nominating first switch output, setting the pointer to a second switch output next in sequence to the first switch output; and,

accepting the nominating switch output closest in succession

5 to second switch output in a subsequent decision cycle.

19. The method of claim 18 wherein arbitrating between the plurality of available switch inputs includes:

setting a maximum number of arbitration cycles in each

10 decision cycle;

if each switch output has not selected a switch input, continuing the arbitration cycles;

if each switch output has selected a switch input, ending arbitration; and,

15 if the maximum number of arbitration cycles is reached, ending arbitration.

20. The method of claim 19 further comprising:

for each switch output locked to a switch input, checking the

20 number of cells in the information packet remaining to be transferred; and,

if the number of remaining cells is one or greater, bypassing the arbitration process.

25 21. The method of claim 20 further comprising:

if no cells remain in the information packet to be transferred, arbitrating between the plurality of switch inputs in a subsequent decision cycle.

5 22. A method for transferring information across a switch connection, the method comprising:

accepting variable length information packets at a plurality of switch inputs, addressed to a plurality of switch outputs;

for each switch output, selecting a switch input;

10 completely transferring the information packet at the selected switch input to the switch output; and,

following the completed transfer, reselecting a switch input.

15 23. An arbitration system for transferring information across a switch, the system comprising:

a queuing device with a plurality of inputs to accept information packets having a variable number of cells, the queuing device having a plurality of outputs to supply the information packets and a control output to supply a status message communicating the status and

20 length of the accepted information packets;

a switch having a plurality of switch inputs connected to the queuing device outputs and a plurality of switch outputs, the switch connecting switch inputs to switch outputs in response to commands accepted at a control input; and,

25 wherein the switch locks a link between a switch input and a switch output to transfer the information packets.

24. The system of claim 23 wherein the queuing device processes the information packets in units of one cell per decision cycle; and,

5 wherein the switch transfers the contents of each information packet, from switch input to switch output, in units of a cell.

10 25. The system of claim 24 wherein the queuing device accepts a first information packet at a first input, with a first plurality of cells, addressed to a first switch output, and supplies the first information packet at a first queuing device output; and,

15 wherein the switch has a first input connected to the first output of the queuing device, the switch linking the first input to a first switch output, and transferring the contents of the first information packet, from the first switch input to the first switch output, one cell at a time, until the transfer is complete.

20 26. The system of claim 24 wherein the switch accepts information packets at a plurality of available switch inputs, and where a plurality of available switch inputs accept information packets addressed to a common switch output;

25 the system further comprising:
an arbiter having an input connected to the status message output of the queuing device for arbitrating between the plurality of available switch inputs and supplying switch commands, responsive to the

link arbitration, at an output connected to the control input of the switch; and,

wherein the switch links the selected switch input to the switch output in response to switch commands from the arbiter.

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27. The system of claim 26 wherein the arbiter arbitrates between the plurality of available switch inputs addressing the common switch output by selecting least recently used available switch input.

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28. An arbitration system for transferring information across a switch, the system comprising:

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a queuing device with a plurality of inputs to accept information packets having a variable number of cells, at each input channeling the information packets into a first plurality of virtual output queues in response to the switch output to which the information packet is addressed, processing the information packets into units of a cell, and supplying the information packets at a plurality of outputs, the queuing device having a control output to supply a status message communicating the status and length of the accepted information packets;

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a switch including available switch inputs with information packets in virtual output queues addressing a common switch output, the switch connecting switch inputs to switch outputs in response to commands accepted at a control input;

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an arbiter having an input connected to the status message output of the queuing device for arbitrating between the plurality of available switch inputs by selecting the least recently used available

switch input, the arbiter supplying switch commands, responsive to the link arbitration, at an output connected to the control input of the switch; and,

5 wherein the switch locks the link between a virtual queue in a switch input and a switch output, in response to commands from the arbiter, to transfer the information packets in units of a cell until the transfer is complete.

29. The system of claim 28 wherein the arbiter establishes
10 an available input priority list for each switch output and nominates
 switch inputs in response to the available input priority list.

30. The system of claim 29 wherein the arbiter arbitrates
 between a plurality of available switch inputs addressing the common
15 switch output in a plurality of arbitration cycles.

31. The system of claim 30 wherein the arbiter
 simultaneously nominates an available switch input for each arbitrating
 switch output.

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32. The system of claim 31 wherein the arbiter nominates
 the highest priority available switch input for each arbitrating switch
 output in a first arbitration cycle, and if the nominated switch input is not
 selected, the arbiter nominates successively lower priority available
25 switch inputs in subsequent arbitration cycles.

33. The system of claim 32 wherein the arbiter establishes an available input priority list by creating a sequential input pointer for each switch output, and following the acceptance of a nominating switch output by a first available switch input, setting the pointer to a second switch input next in sequence to the first available switch input; and,

5 wherein the arbiter nominates the highest priority available switch input in a subsequent arbitration cycle by nominating the available switch input closest in succession to the second switch input.

10 34. The system of claim 33 wherein the arbiter, following the nomination of available switch inputs for arbitrating switch outputs, arbitrates between nominating switch outputs for each switch input receiving multiple nominations.

15 35. The system of claim 34 wherein the arbiter accepts the least recently used nominating switch outputs in arbitrating between the nominating switch outputs.

20 36. The system of claim 35 wherein the arbiter accepts the least recently used nominating switch outputs by establishing a nominating output priority list for each switch input, the arbiter accepting nominating switch outputs in response to the nominating output priority list.

37. The system of claim 36 wherein the arbiter simultaneously accepts a nominating switch output for each arbitrating switch input.

5 38. The system of claim 37 wherein the arbiter establishes a nominating output priority list by creating a sequential output pointer for each switch input, and following the acceptance of a nominating first switch output in a first arbitration cycle, sets the pointer to a second switch output next in sequence to the first switch output; and,

10 wherein the arbiter accepts the highest priority nominating switch output in a subsequent decision cycle by accepting the nominating switch output closest in succession to second switch output.

15 39. The system of claim 28 further comprising:
a timer having an output to supply a decision cycle signal made up of a plurality of arbitration cycles;
wherein the switch has an input connected to the output of the timer, the switch locking the links to transfer the information packet contents in units of one cell per link, every decision cycle in response to
20 signals from the timer; and,
wherein the arbiter arbitrates between inputs and outputs in response to signals from the timer.

25 40. The system of claim 41 wherein the timer supplies a decision cycle signal with a maximum number of arbitration cycles per decision cycle; and,

wherein the arbiter continues arbitration in a subsequent arbitration cycle, if each switch output is not linked to a switch input;

wherein the arbiter ends arbitration if each switch output is linked to a switch input; and,

5 wherein the arbiter ends arbitration if the maximum number of arbitration cycles is reached.

41. The system of claim 40 wherein the arbiter sends commands to lock the switch links by checking the number of cells in the 10 information packet remaining to be transferred for each switch output locked to a switch input, and if the number of remaining cells is one or greater, bypassing the arbitration process; and,

wherein the arbiter arbitrates between a plurality of switch inputs, for a common output, in a subsequent decision cycle if no cells 15 remain in the information packet to be transferred.